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VA—18—2024

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2024

(CBCS/New Pattern)

PHYSICS

Paper–XV

(Fibre Optic Communication)

(Tuesday, 3-12-2024)   **Time : 10.00 a.m. to 12.00 noon**

Time—2 Hours   *Maximum Marks—40*

N.B. :— (*i*)   *All* questions are compulsory.

(*ii*)   Use of non-programmable calculator and log table is allowed.

1.   Describe in detail :   15

(*i*)   Snell's law

(*ii*)   Total internal reflection.

Or

(*a*)   Describe in brief modes in graded index fibre.   8

A graded index fibre has a core with a parabolic refractive index profile which has a diameter of 50 μm. The fibre has a numerical aperture of 0.2. Estimate the total number of guided modes propagating on the fibre when it is operating at a wavelength of 1 μm.

P.T.O.

(b) Write down expressions for index variation of graded index fibre. Describe the ray transmission in the graded index fibres. 7

2. Describe with the aid of simple ray diagrams : 15

(i) The multimode step index fibre

(ii) The single mode step index fibre and compare the advantages and disadvantages of these two fibres for use as an optical channel.

Or

(a) Derive an expression for the cut-off wavelength. 8

(b) Estimate the maximum core diameter for an optical fibre with relative refractive index difference (1.5%) and core refractive index (1.48) which is operating at wavelength of 0.85 μm. Further estimate the new maximum core diameter for single mode operation when the relative refractive index difference is reduced by a factor of 10. 7

3. Write notes on any *two* : 10

(a) Advantages of single mode fibre

(b) Intermodal dispersion in the multimode graded index fibre.

(c) Acceptance angle

(d) Normalized frequency.